WHAT SCIENTIFIC MANAGEMENT MEANS TO AMERICA'S INDUSTRIAL POSITION

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There is some confusion today as to the meaning of scientific management. This concerns itself with the nature of such management itself, with the scope or field to which such management applies, and with the aims that it desires to attain. Scientific management is simply management that is based upon actual measurement. Its skilful application is an art that must be acquired, but its fundamental principles have the exactness of scientific laws which are open to study by everyone. We have here nothing hidden or occult or secret, like the working practices of an old-time craft; we have here a science that is the result of accurately recorded, exact investigation. Its results are formulated, or are being formulated, into such shape that they may be utilized by all who have the desire to study them and the concentration to master them. The leaders in the field are, as rapidly as possible, publishing these results, that progress may take place from the stage of highest present achievement, and that no time or effort may be wasted in re-making investigations whose results are already known and accurately recorded. The scope of this management, which may truly be called scientific, is unlimited. It applies to all fields of activity, mental and physical. Its laws are universal, and, to be of use in any particular field, require only to be translated into the vocabulary of the trained and progressive workers in that field.

The greatest misunderstandings occur as to the aims of scientific management. Its fundamental aim is the elimination of waste, the attainment of worth-while desired results with the least necessary amount of time and effort. Scientific management may, and often does, result in expansion, but its primary aim is conservation and savings, making an adequate use of every ounce of energy of any type that is expended.

Scientific management, then, in attacking any problem has in mind the question—How may what is here available be best used? It considers the problem, in every case, according to the scientific method; that is, by dividing it into its elements and submitting each one of these to detailed study. Every problem presents two elements: the human element, and the materials element. By the materials element we mean the type of material used, the quality of material used, the quantity of material used, the manner in which the material is used, with conclusions as to why the material is chosen and handled as it is. In other words, we would apply to the material the familiar questions, what, how much, how, when, where, and why. These same questions are applied to the human element; that is to say, to all members of the organization.

Having in mind now the principles and practice of scientific management, we can consider its relation to the industrial position of any country. Industrial growth, like all other growth, consists of progress and maintenance; that is, of advances over and beyond present achievement and of making adequate provision for holding any advantage that one may gain. It is generally realized that maintenance contains always the thought of conservation, that it is impossible to hold any advantage without making careful provision for using one's resources in the best possible manner. It is not so generally realized that progress also implies constantly this same conservation. The reason for this is the result of a confusion between saving, or conserving, and hoarding. True conservation contains no thought of miserliness or niggardliness. It is based upon a broad outlook on life and upon the needs of the situation, upon a willingness to pay the full, just price for what is wanted, but an unwillingness to pay any more than is necessary. Progress differs from lack of progress, fundamentally, not because the progressive man is willing to pay more than the unprogressive man will, but because the progressive man has a broader outlook and a keener insight, hence, a more adequate knowledge of where and when it is necessary to pay. The unprogressive man or nation suffers from a limited outlook that makes it practically impossible to make a just estimate as to what is worth while.

When we compare the various countries of the world, and try to estimate their relative industrial positions, we find a strong relationship between conservation in its highest sense and industrial

supremacy. Again, as we turn to history, we find this same relationship constantly manifesting itself; that is, progress depending upon an ability to see what is worth-while, and a willingness to pay for that and that only, and stability or maintenance depending upon an efficient handling of available resources.

As we review history, and observe present conditions, we see that the differences between various countries are becoming less and less, as time goes on. Transportation, with its numerous by-products that affect both the material and the human element, is increasing the likenesses between different countries at an astounding rate. This means that industrial supremacy will depend more and more upon the handling of available resources and less and less upon distinctive features in these resources themselves. The calamitous war, which is now apparently offering such a serious check to industrial progress, is contributing toward ultimately making working conditions more similar, in that many countries are being thrown upon their own resources for both materials and men, and are being forced to make discoveries that will more nearly equalize these resources.

Another outcome of this war, that should prove of advantage to the world, is the emphasis that is being laid upon the causes of industrial position and industrial supremacy and the resulting study that is being made as to the reasons for such supremacy. Such a study should be particularly profitable here in America. This country has always conceded her important industrial position. She has realized thoroughly her enormous natural resources and also her wonderful human resources in that she is "the melting pot of the nations." It is only within the lifetime of those still young among us that we have come to realize the necessity of conserving our natural resources. It has not yet reached the attention of many among us that our human resources are as worthy, in fact, infinitely more worthy, of being conserved.

It is self-evident, then, that to attain and maintain an industrial position of which she may be proud, America must conserve both her natural and her human resources. If she hopes for industrial supremacy, she must set about this conservation with energy, and must pursue it unremittently.

The writers have a thorough knowledge of European industrial conditions, through having done business simultaneously in

this country and abroad for many years, through frequent trips abroad before the war, through having crossed the boundaries of many of the warring countries many times since the outbreak of the war, and through having observed carefully industrial conditions and methods. Their opinion, which is that of all who have made intensive studies of these conditions, is that America is far behind European countries in conservation of the materials element, both natural and manufactured resources. This statement needs no proof in this place. The fact it contains is universally accepted by serious thinkers and investigators. It is equally true that up to recent times European countries have done comparatively little toward conserving the human element.

The hope of this country lies, then, in equaling or surpassing foreign conservation of material and in maintaining or progressing beyond our present conservation of the human element. The material problem is being attacked along different lines in a more or less systematic manner. We all appreciate the benefits of scientific or intensive farming, until now our native farmers, working under the direction of and with the coöperation of the Department of Agriculture, get results that equal those of European farmers, in their native lands, or here in ours. The importance of laboratory analysis of materials and the help that applied science can render and is more and more rendering to the industries are also being recognized. Agricultural experience has taught the valuable lesson that it is possible to get great output, yet, at the same time, leave the producing force unimpaired, by a proper expenditure of money and brains. Experience with applied science has taught that by-products, as well as products, must be considered, and that the exact methods of science often bring results that are beyond those looked for or hoped for. It has been common practice to consider a transaction satisfactory, or better, if it fulfilled one's expectations, to lay emphasis upon the result rather than to standardize the means or method. Laboratory practice has taught that while the immediate results are important, the standardization of the method is more important, since the unexpected ultimate results, sometimes called by-products, are often by far the most valuable outcome of the work. Certain industries in this country have gone far toward applying scientific methods to the material element, but no one of us need go outside his own experience to be able to mention

other industries that as yet have no conception of what such work means.

Much has been done not only in the analysis of materials, but also with the handling of materials. America has cause to be proud of her machines and her tools. The chief criticism that we may make of present practice in this field is that of lack of standardization. The reasons for this are many. One is business competition, though the feeling is gradually dying out that making one's product markedly different from that of all others is a strong selling advantage. Another is the strong feeling of independence and individuality that leads one to prefer a thing because it is different rather than because it is adequate to the purpose for which it is needed. A third is a lack of channels for direct and easy communication of ideas. This is being supplied both through organizations and publications. A fourth is the former lack of standardizing bodies or bureaus, a lack which is also being supplied as the demand for such bodies increases.

Because of the highly specialized nature of much present-day work, few of us realize how widespread, almost universal, the lack of standardization is. It is only necessary to turn, however, to such a field of activity as surgery, which engages the attention of some of the finest brains in the country, and which is apt to come, sooner or later, in some way, into the field of experience of everyone, to see a striking object lesson of lack of standardization both of tools and of method.

It is the work of scientific management to insist on standardization in all fields, and to base such standardization upon accurate measurement. Scientific management is not remote, or different from other fields of activity. For example, in the handling of the materials element, it does not attempt to discard the methods of attack of intensive agriculture or of the laboratory of the applied scientists; on the contrary, it uses the results of workers in such fields as these to as great an extent as possible.

There is a widespread feeling that scientific management claims to be something new, with methods that are different from those used by other conserving activities. This is not at all the case. It is the boast of scientific management that it gathers together the results and methods of all conserving activities, formulates these into a working practice, and broadens their field of

application. In handling the materials element, then, scientific management analyzes all successful existing practices in every line, and synthesizes such elements as accurate measurement proves to be valuable into standards. These standards are maintained until suggested improvements have passed the same rigid examination, and are in such form that they may be incorporated into new standards.

Turning now to the field of the human element—by far the the more important field—we find that, while there is much talk of work in that field today, comparatively little has actually been accomplished. There have, in all places and times, been more or less spasmodic and unsystematic attempts to conserve human energy, or to use it for the greatest benefit of all concerned; but there has not been steady and conspicuous progress in this work for several reasons; 1. Because the methods used were not accurately measured and were not standardized. This made it impossible for the individual conserver to accomplish much of lasting benefit. 2. Because of lack of coöperation between such conservers.

It is the task of scientific management to supply both these wants. Success in handling the human element, like success in handling the materials element, depends upon knowledge of the element itself and knowledge as to how it can best be handled. One great work of scientific management has been to show the world how little actual knowledge it has possessed of the human element as engaged in the work in the industries. Through motion study and fatigue study and the accompanying time study, we have come to know the capabilities of the worker, the demands of the work, the fatigue that the worker acquires at the work, and the amount and nature of the rest required to overcome the fatigue.

Those not actively interested in the industries can scarcely realize that the process of keeping the soil at its full producing capacity and of providing depleted energy is infinitely more standardized and more widely used than the process of providing that the human organism overcome fatigue and return to its normal working capacity in the shortest amount of time possible. Scientific provision for such recovery in the industries, before the days of scientific management, was unknown.

It is even more surprising that only the pioneers in the work realize the application of any necessity for the laboratory method

in the study of the human element as it appears in the industries. When making accurate measurements, the number of variables involved must be reduced to as great a degree as possible. Only in the laboratory can this be successfully done. It is fortunate for scientific management that its initial introduction in the industries has been made by engineers rather than by men who are primarily laboratory scientists, for this reason: the engineer has been forced by his training to consider constantly immediate as well as ultimate results, and present as well as future savings. Investigations of scientific management have, therefore, been made to pay from the start in money savings, as well as in savings of energy of all kinds. We note this in the results of motion study, fatigue study, and the accompanying time study.

As an example, take the laboratory investigations in motion study. These, where possible, are made by us in the laboratory, which is a room specially set apart in the plant for research purposes. Here the worker to be studied, with the necessary apparatus for doing the work and for measuring the motions, and the observer, investigate the operation under typical laboratory conditions. The product of this is data that are more nearly accurate than could be secured with the distractions and many variables of shop conditions. The by-product of this work, which is a typical by-product of engineer-scientists' work, is that the conditions of performing the operation in the laboratory become a practical working model of what the shop conditions must ultimately be. When the best method of doing the work with the existing apparatus has been determined in the laboratory, the working conditions, as well as the motions that make this result possible, are standardized, and the working conditions in the shop are changed, until they resemble the working conditions in the laboratory. In the same way, the length and periodicity of intervals to be allowed for overcoming fatigue, and the best devices for eliminating unnecessary fatigue and for overcoming necessary fatigue, are determined during the investigation, and are incorporated into shop practice.

The various measurements taken by scientific management and the guiding laws under which these are grouped determine not only the nature of the human element, but the methods by which it is to be handled. Motion study, fatigue study, the measures supplied by psychology,—these result in the working practice that

fits the work to the worker, and produces more output with less effort, with its consequent greater pay for every ounce of effort expended.

Through scientific management, then, the individual conserver is enabled to progress constantly and to maintain each successful stage in the development. Scientific management can, also, and does, wherever permitted, provide for coöperation among conservers. It does this by:

1. Demonstrating the enormous waste resulting from needless repetition of the same investigation.
2. Providing standards which must be recognized as worthy of adoption, since they are the results of measurement.
3. Emphasizing the importance of teaching and of the transference of skill, which depend upon coöperation.
4. Showing that maintenance depends, in the final analysis, upon coöperation.

We have formulated our program for such coöperation into the following stages:

1. Each individual to apply scientific management to his own activities, individual and social.
2. Groups, such as industrial organizations, to apply scientific management to the group activity.
3. Trades to apply scientific management to the trade activity. This includes, ultimately, a reclassification and standardization of the trades, such as we have advocated in *Motion Study*.[1] The trades must be classified according to the amount of skill involved in the motions used, and must then be standardized in order that the necessary training for succeeding in them can be given.
4. Industries to apply scientific management to the entire industry, with coöperation between the various trades involved.
5. A national bureau of standardization to collect and formulate the data from all the industries into national standards.
6. An international bureau of standardization to collect national standards and to work for international coöperation.

America's immediate industrial position depends upon America's realization of the need for conservation, as demonstrated by scientific management, and upon America's use of such means of conservation as scientific management offers.

America's ultimate industrial position depends upon America's realization that the highest type of conversation includes coöperation.

Individuals, groups, trades, and industries have realized and are realizing more and more, daily, that it is for the good of all that

[1] D. Van Nostrand Company, pages 94–103.

common practice be standardized and that improvements take place from the highest common standard. Nations have not yet come to any great realization that this same principle applies to international relationships.

If America desires to gain and maintain leadership in industrial progress, she must be the advocate of industrial conservation and coöperation, and must be the example of that readiness to derive and to share standards for which scientific management stands.